

## EFFECT OF SURYANAMASKAR ON STATIC BALANCE OF SCHOOL GIRLS

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### ABSTRACT

The objectives of the study were to determine the main effect of training durations (within-groups), the main effect of groups (between-groups) and interaction effect (combined effect of training durations and groups) on static balance due to practices of Suryanamaskar. Mixed design was used for the study. Three groups were created (pace 1, pace 2 and pace 4 groups). 10 girls were in each group in the range of 15 – 17 years. First experimental group performed one round of Suryanamaskar in 1 minute pace, second experimental group in 2 minutes and third experimental group in 4 minutes. Total treatment duration was six weeks. Static balance was measured by stork stand test in seconds before (pretest), after 3 weeks and after 6 weeks of all three groups. 3 x 3 mixed factorial ANOVA was used and level of significance was set at 0.05. The findings of the study revealed that practice of Suryanamaskar for 3 weeks and 6 weeks are sufficient to bring out significant improvement on static balance (main effect of training duration). There was no interaction effect as in all three groups, improvement in static balance is almost similar way after 3 weeks and 6 weeks (interaction effect). There was no significant difference found among three groups (main effect of groups) on static balance at pretest, after 3 weeks and after 6 weeks. The beneficial effects of Suryanamaskar practices are as similar as physical activities. It can be applied to all schools to improve the balance ability of the students and it is good option for complete physical fitness.

**Keywords:** Pace, Static Balance and Yoga.

### INTRODUCTION

Suryanamaskar or sun salutation is a traditional Indian yogic practice, renders the benefits of stretching, static, and dynamic exercise. Each round of Suryanamaskar practice involves practicing 12 postures in succession with forward and backward bending along with deep exhalation and inhalation respectively to the maximum possible extent. Many people practice several rounds of Suryanamaskar for their regular physical fitness program. Balance is the ability to maintain equilibrium against the force of gravity. Balance is necessary not only in sports and related physical activities but also in our usual, everyday activities. Individual with poor balance are at a disadvantage in efficiently performing most physical activities. Also, these individuals are at a greater risk of fall and injure themselves during physical activities. An individual can be improved his balance ability through appropriate physical activities (Miller, 2006). Suryanamaskar is itself a proper physical activity because it gives all that benefits which we get through physical activities. Suryanamaskar is itself complete yogic practice because it benefited at all levels of an individual (physical level, physiological level and also psychological level). There are plenty of studies have been done to see the effect of yogic asanas on physical and physiology variables. Suryanamaskar is itself combination of six asanas. (Shankar and Pancholi, 2011). Going through many research papers this query has been raised that change in the pace of Suryanamaskar will effect on balance ability (Bhavanani, 2011).

### METHODS

**Subjects:** The subjects for this study were selected from the Kiddy's Corner School, Gwalior. Thirty six girls in the range of 15 – 17 years from class 11<sup>th</sup> and 12<sup>th</sup> were selected randomly for this study. Only thirty girls were able to complete 6 weeks Suryanamaskar practices.

**Variables:** Suryanamaskar was considered as independent variable and static balance was considered as dependent variable.

**Test for Static Balance:** Static balance was measured by stork stand test. Subject stands on the foot of the dominant leg, place the other foot against the inside of the supporting knee, and places the hands on the hips. On the signal "Go" the performer raises the heel of the dominant foot from the floor and attempts to maintain balance as long as possible. The test administrator counts the numbers of seconds the performer is able to maintain balance. The trial is ended when the hands are move from its hips, when the ball of the dominant foot move from its original position, or when the heel touches the floor. Three trials are administered. Scoring: The best time, in seconds, of three trials is the score.

**Experimental Design:** Mixed-Model design (between-within group design) was used for the study. The experimental treatment was assigned randomly into three groups. Ten girls were in each group. The data was collected from all the four groups before

the training (pre-test), after 3 weeks and after 6 weeks training of Suryanamaskar. First experimental group performed one round of Suryanamaskar in 1 minute pace, second experimental group performed in 2 minutes pace, third experimental group performed in 4 minutes. Total treatment duration was six weeks. All participants were briefed introduced about general objectives and requirement of Suryanamaskar. Suryanamaskar training was carried for a period of six weeks, five days per week between 1-9-2013 to 20-10-2013. The scheduled time of practice was during their physical education period for 40-45 minutes. Suryanamaskar practice was demonstrated to the group by the research scholar and most important points were reviewed several times. The pace of Suryanamaskar was control by watch. To determine the effect different paces of Suryanamaskar on vital capacity on school girls 3 x 3 between-within factorial ANOVA and level of significant was set at 0.05. 12 steps of Suryanamaskar are following (Saraswati, Swami, 2002).

Steps	Asana	Pace 1	Pace 2	Pace 4
1 & 12	Pranamasana	5 + 5 = 10	10 + 10 = 20	20 + 20 = 40
2 & 11	Hasta utthanasana	5 + 5 = 10	10 + 10 = 20	20 + 20 = 40
3 & 10	Padahasthasana	5 + 5 = 10	10 + 10 = 20	20 + 20 = 40
4 & 9	Ashwasanchalanasana	5 + 5 = 10	10 + 10 = 20	20 + 20 = 40
5 & 8	Parvatasana	5 + 5 = 10	10 + 10 = 20	20 + 20 = 40
6	Ashtanganamaskara	5	10	20
7	Bhujangasana	5	10	20
		Total = 60 seconds	120 seconds	240 seconds

## RESULTS

**Table No.1**

Descriptive Statistics of Static Balance of different groups and training durations of Suryanamaskar

	Groups	Mean	S.D.	N
Pretest	Pace 1	8.89	4.36	10
	Pace 2	10.28	6.16	10
	Pace 4	11.52	4.31	10
	Total	10.23	4.97	30
03 Weeks	Pace 1	10.83	3.62	10
	Pace 2	12.12	5.40	10
	Pace 4	14.22	4.49	10
	Total	12.39	4.63	30
06 Weeks	Pace 1	14.06	2.49	10
	Pace 2	14.73	4.50	10
	Pace 4	16.06	1.48	10
	Total	14.95	3.10	30

In Table No. 1 Mauchly's test was applied to check the assumption of sphericity. The p-value was 0.00 which was less than 0.05, so we found that the assumption of sphericity has been violated.

**Table No.1**

Mauchly's Test of Sphericity for Training Duration

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	p-value	Epsilon <sup>b</sup>		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Duration	.506	17.725	2	.000	.669	.743	.500

Above table shows that the assumption of sphericity was violated after that we used Greenhouse-Geisser correction, because epsilon value was less than 0.75.

**Table No.2**  
Tests of Within-Subjects Effects for Training Durations and Interaction

Source		Type III Sum of Squares	Df	Mean Square	F	p-value	Partial Eta Squared
Duration	Greenhouse-Geisser	334.87	1.33	250.19	47.93	.00	.64
Duration *groups	Greenhouse-Geisser	5.73	2.67	2.14	.41	.72	.03
Error(duration)	Greenhouse-Geisser	188.61	36.13	5.21			

Above table shows that there was a significant main effect of training durations on static balance as the p-value was 0.00 which was less than 0.05. It also shows that there was no significant interaction effect between groups and training durations as the p-value is 0.72 which is greater than 0.05. Partial eta<sup>2</sup> in the above table explains 64% of variance of training durations and 3% of variance was explained by the interaction, which shows variance of interaction between training durations and groups. Partial eta<sup>2</sup> of training duration indicate very large effect size and interaction indicate low effect size.

**Table No.3**  
Tests of Between-Subjects Effects for Groups

Source	Type III Sum of Squares	Df	Mean Square	F	p-value	Partial Eta Squared
Intercept	14125.06	1	14125.06	290.09	0.00	0.91
Groups	108.38	2	54.19	1.11	0.34	0.07
Error	1314.65	27	48.69			

Above table shows that there was no significant difference found among groups (pace 1, pace2 and pace 4) on their static balance due to suryanamaskar practice as the p-value was 0.34 which was greater than 0.05. Partial eta<sup>2</sup> in the above table explains 7% of variance of groups, which indicated low effect size.

**Table No.4**  
Marginal Means of Static Balance Among Training Durations

Time	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Pretest	10.23	0.91	8.35	12.11
3 weeks	12.39	0.83	10.68	14.10
6 weeks	14.95	0.6	13.79	16.11

From table 2 it is evident that there is a significant main effect of training duration. Now to compare between different durations (i.e. to know exactly where the differences between reading durations exist) Pair wise comparisons between overall durations after Bonferroni adjustment for confidence interval was done. The results are shown in the table underneath.

Table No.5  
Pair wise Comparisons of Durations

(I) time	(J) time	Mean Difference (I-J)	Std. Error	p-value	95% Confidence Interval for Difference <sup>b</sup>	
					Lower Bound	Upper Bound
Pre test	3 weeks	-2.16*	.26	0.00	-2.83	-1.48
	6 weeks	-4.71*	.56	0.00	-6.15	-3.28
3 weeks	Pre test	2.16*	.26	0.00	1.48	2.83
	6 weeks	-2.55*	.56	0.00	-3.98	-1.13
Based on estimated marginal means						
*. The mean difference is significant at the .05 level.						
b. Adjustment for multiple comparisons: Bonferroni.						

Above table shows that there was a significant difference found between pretest and after 3 weeks, between pretest and after 6 weeks and between after 3 weeks and after 6 weeks as the p-value was less than 0.05.

## DISCUSSION

The objectives of the study were to determine the main effect of training durations (within-groups), the main effect of groups (between-groups) and interaction effect (training durations x groups) on static balance due to practices of Suryanamaskar. The finding of the study revealed that practice of Suryanamaskar for 3 weeks and 6 weeks are sufficient to bring out significant improvement on static balance (main effect of training duration). In all three groups, improvement in static balance is almost similar way after 3 weeks and 6 weeks (interaction effect). There is no significant difference found among three groups (main effect of groups) on static balance at pretest, after 3 weeks and after 6 weeks. The integration of visual, vestibular, and somato sensory components are used to maintain one's postural balance. Postural control changes over time and body sway increases with age. The different sensory systems begin to develop and refine starting when children are young, while in older adults it begins to decline. An individual's ability to maintain balance can be improved through appropriate physical activities. (miller, 2006) and Suryanamaskar practice is also one type of physical activity. Static balance depends primarily on kinesthetic, tactical and to some extends on vestibule sense organs (hair). Neuromuscular coordination can be developed by the help rhythmic physical activities and it is also responsible for balance ability. Suryanamaskar is rhythmic nature and its help to developed neuromuscular coordination. The balance center (semicircular canal) in the inner ear, the kinesthetically sense in the muscles and joints (feel of an activity), and visual perception contribute to balance. In certain position, balance also is affected by strength (miller, 2006). Practices of Suryanamaskar help to improve strength of leg muscles or muscles groups and rhythmic sequence of asanas (yogic postures) help to improve kinesthetically sense on an individual may be due to this balance improved. Training duration effect and descriptive statistics concluded that practice of Suryanamaskar for 6 weeks were sufficient to bring out significant improvement on static balance. It also concluded that Suryanamaskar practice for 6 weeks with pace 4 help to improve maximum static balance as compare pace 1 and pace 2. In pace 4 group performed Suryanamaskar was much static in nature because each asana (postures) took around 20 seconds, due to this static balance improved in pace 4 group better than other groups. The beneficial effects of Suryanamaskar practices are as similar as physical activities. It can be applied to all schools to improve the balance ability and it is good option for complete physical fitness.

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